**🛡️ STATION 3: “Build-A-Bandage” – DIY Burn Wrap Design Sprint**

**NGSS Standards: HS-PS1-3, HS-PS3-4**
**Concept:** Design and test your own cooling wrap to simulate real-world first aid solutions. Explore how different materials affect **thermal energy transfer** and how chemical/physical properties contribute to healing performance.

**Materials (student choice from a materials bin):**

 Aluminum foil

 Paper towels

 Plastic wrap

 Cotton rounds or pads

 Fabric scraps (cotton, fleece, etc.)

 Medical or masking tape

 Resealable plastic bags (pre-filled with warm water ~40–45°C)

 Ice cubes

 Stopwatch

 Thermometer

 Ruler (optional, to measure wrap thickness)

**Student Directions:**

**Step 1:Set Up the “Burn Site”**

* Fill a resealable plastic bag with warm water (~40–45°C) to simulate burned skin. Seal tightly.
* This will be your *test surface*. Place it flat on the table.

**Step 2: Design Your Wrap**

* Choose 2–3 materials from the bin to build a custom cooling bandage.
* You may **layer** materials (e.g., paper towel under foil, or cloth + plastic wrap) to combine comfort and heat-shielding.
* Use tape to hold the design together if needed.
* OPTIONAL: Use a ruler to measure or record the **thickness** of your wrap.

**Step 3: Test Cooling Efficiency**

* Wrap your DIY bandage around the plastic bag.
* Place an **ice cube on top** of the bandage.
* Start the stopwatch.
* Measure the **internal temperature** of the water in the bag **once every minute for 5 minutes.**
* Record your results.

**📊 Data Table:**

| **Time (min)** |  **Internal Temp (°C)** |
| --- | --- |
| 0 (start) |  |
| 1 min |  |
| 2 min |  |
| 3 min |  |
| 4 min |  |
| 5 min |  |

**💬 Analyze & Reflect:**

1. **Did your design lower the temperature by at least 10°C within 3 minutes?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. **Which material(s) do you think helped most with cooling? Why?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. **Was your wrap comfortable to the touch? Could it be used on real skin?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. **If you had to improve this design for field use (limited supplies, fast action), what would you change?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. **Which properties (absorbency, insulation, flexibility) mattered most in your final design?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**🧠 Wrap-Up Reflection:**

Have students reflect in journals or in small groups:

* What makes an ideal first aid wrap?
* How does temperature impact chemical and biological reactions?
* Why is measurement and testing essential in designing real medical products?

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**NGSS Standards:**

* **HS-PS1-3** – Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
* **HS-PS3-4** – Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperatures are combined within a closed system results in a more uniform energy distribution.

**✅ ITEEA STEL Standards – High School**

**STEL 1H** – *Technological systems include input, processes, output, and feedback.*
→ Students create and test a system (bandage) where material inputs affect the thermal energy output (cooling effectiveness).

**STEL 2H** – *Core concepts of technology include energy and matter.*
→ Students explore thermal energy transfer, insulation, and material properties in a medical context.

**STEL 4H** – *The properties of materials influence their applications.*
→ Students select and combine materials based on qualities like absorbency, insulation, or comfort.

**STEL 8H** – *Design is a creative process that leads to useful ideas and solutions.*
→ Learners prototype, test, and iterate a real-world medical design challenge using limited materials.

**STEL 9J** – *Research, development, and experimentation are used to problem-solve and invent.*
→ This hands-on experiment models how engineers develop and test new health and safety technologies.

**✅ Common Core Math Standards – High School**

**CCSS.MATH.CONTENT.HSS.ID.B.6** – *Summarize, represent, and interpret data on two categorical and quantitative variables.*
→ Students measure and compare temperature data over time for different materials.

**CCSS.MATH.CONTENT.HSF.IF.C.7** – *Graph functions expressed symbolically and show key features of the graph.*
→ Optional: Students can graph time vs. temperature to visualize the cooling curve.

**CCSS.MATH.PRACTICE.MP2** – *Reason abstractly and quantitatively.*
→ Learners analyze temperature changes and rate of cooling using real data.

**CCSS.MATH.PRACTICE.MP4** – *Model with mathematics.*
→ This activity models real-life thermal transfer in emergency medicine using measurable variables.

**CCSS.MATH.PRACTICE.MP5** – *Use appropriate tools strategically.*
→ Students practice using tools like rulers, thermometers, and stopwatches to gather and analyze data.

**✅ Summary**

This engineering design activity aligns with **NGSS HS-PS1-3** and **HS-PS3-4**, allowing students to explore **thermal energy transfer** and **material science** in a biomedical application. It is also directly connected to **ITEEA STEL design and materials standards**, and supports **Common Core Math** through data collection, analysis, and real-world problem solving.